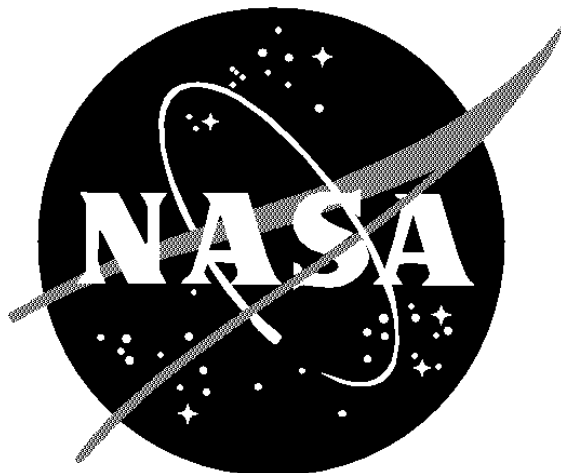


**National Aeronautics and
Space Administration**

**May 18, 2001
OMB Approval No. 2700-0087**



EARTH SYSTEM SCIENCE PATHFINDER (ESSP) MISSIONS

NASA Announcement of Opportunity

**Soliciting Proposals
for
Period Ending
July 20, 2001**

AO-01-OES-01

**Office of Earth Science
National Aeronautics and Space Administration
Washington, DC 20546**

**Notice of Intent due June 22, 2001
Proposals Due July 20, 2001**

EARTH SYSTEM SCIENCE PATHFINDER (ESSP) MISSIONS

Announcement of Opportunity

Table of Contents

1.0	Description of Opportunity	1
1.1	Introduction	
1.2	Proposal and Evaluation Process	
1.2.1	Notice of Intent	
1.2.2	Cover Page	
1.2.3	Pre-proposal Conference	
1.2.4	Two Step Proposal Process	
1.2.5	Earth System Science Pathfinder Project Library	
1.2.6	Notice to Offerors	
1.3	Commercial Endeavors Provision	
1.4	Scientific/Applications and Technical Inquiries	
1.5	Proposal Opportunity Period and Schedule	
2.0	Program Objectives	8
2.1	Programmatic Objectives	
2.2	Scientific Objectives	
2.3	Announcement Objectives	
3.0	Program Constraints, Guidelines and Requirements	13
3.1	General Program Constraints	
3.1.1	Available Funding	
3.1.2	Mission Readiness	
3.1.3	Mission Options	
3.1.4	Launch Services	
3.2	General Program Guidelines	
3.2.1	Mission Teaming	
3.2.2	Contributions	
3.2.3	Data Dissemination	
3.3	Foreign Participation	
3.4	Science/Applications Requirements	
3.5	Technical Requirements	
3.6	Cost Requirements	
3.7	Management Requirements	
3.8	Educational Requirements	
3.9	Other Opportunities	
3.9.1	Participation of Small, Small Disadvantaged, and Women-owned Small Businesses, and Minority Institutions	
3.9.2	Commercialization	
4.0	Proposal Preparation and Submission Guidelines	29
4.1	Format and Content	
4.2	Proposal Submission Information	
4.2.1	Endorsements and Certifications	
4.2.2	Quantity	

4.2.3	Electronic Version of Proposal	
4.2.4	Submittal Address	
4.2.5	Submittal Deadline	
4.2.6	Notification of Receipt	
5.0	Proposal Evaluation, Selection, and Implementation	31
5.1	Step-One Evaluation Criteria	
5.1.1	Scientific/Applications Merit Criterion	
5.1.2	Mission Implementation Plan Criterion	
5.2	Step-Two Evaluation Criteria	
5.2.1	Scientific/Applications Merit Criterion	
5.2.2	Technical Implementation Plan Criterion	
5.2.3	Management Plan Criterion	
5.2.4	Cost Risk and Cost Realism Criterion	
5.2.5	Educational Criterion	
5.2.6	Other Opportunity Criterion	
5.3	Evaluation and Selection Process	
5.3.1	Step-One Process	
5.3.2	Step-Two Process	
5.3.3	Mission Confirmation Review Process	
5.4	Contract Administration and Funding	
6.0	Conclusion	42

APPENDICES

Appendix A	NASA Earth Science Research Strategy for 2000-2010
Appendix B	Contents of the ESSP-3 AO Library
Appendix C	Launch Services Cost Table
Appendix D	Mission Confirmation Review Process
Appendix E	Regulations Governing Procurement of Foreign Goods or Services
Appendix F	Elements to be Included in Arrangements Between U.S. Proposal Team Leaders and Cooperating Foreign Parties
Appendix G	Earth Science Enterprise Data and Information Systems and Services Interfaces and Standards
Appendix H	Mission Assurance Guidelines and Requirements
Appendix I	General Instructions and Provisions
Appendix J	Flight and Ground Safety Requirements
Appendix K	Proposal Format and Content
Appendix L	Charts and Templates
Appendix M	AO Acronyms
Appendix N	Glossary of Terms
Appendix O	Certification Regarding Debarment, Suspension and Other Responsibility Matters Primary Covered Transactions
Appendix P	Certification Regarding Lobbying
Appendix Q	Civil Rights Certification
Appendix R	Mission Definition and Requirements Agreement (MDRA), example
Appendix S	ESSP Documents Required By Mission Design Review

Earth System Science Pathfinder (ESSP) Mission Announcement of Opportunity

1.0 DESCRIPTION OF OPPORTUNITY

1.1 Introduction

The National Aeronautics and Space Administration (NASA) announces the opportunity to conduct space missions and acquire the data to understand high priority but least understood Earth System processes, or where we have very limited understanding of the controlling forces on the Earth System and the Earth's response to such forcings.

Additional information on NASA's Earth Science and Applications priorities for this announcement is provided in Section 2, Appendix A and through appropriate links found on the Office of Earth Science homepage at Internet address <http://www.earth.nasa.gov>.

SPECIAL NOTICE: In an effort to further enhance cooperation between NASA and the European Space Agency (ESA) in the area of Earth Science research and applications, potential proposers to this announcement should be aware that ESA is planning to issue its second call for proposals for Earth Explorer Opportunity Missions. This call is provisionally scheduled for June 2001. Further information regarding ESA's Earth Explorer Opportunity missions and this call for new proposals can be found at <HTTP://www.estec.esa.nl/explorer/>.

1.2 Proposal and Evaluation Process

NASA is aware of the significant burdens placed upon the proposing community in responding with detailed proposals to open Announcements of Opportunity. In order to reduce the overall effort expended by the community in preparing full proposals, NASA plans to conduct a two-step proposal and evaluation process for this AO. Step-One is primarily a science concept screening (with some assessment of the mission's technical risks). At the end of Step-One, NASA will recommend that a limited number of highly rated investigations enter the Step-Two process and prepare full proposals. In the past two ESSP AO's, NASA has selected two primary missions and one alternate mission at the completion of the Step-Two evaluation. For this AO, NASA has altered this approach to select nominally three missions at the completion of the Step-Two evaluation. Each of these missions will be funded to proceed with formulation through the Mission Design Review (MDR) after which NASA will select nominally two or three missions to enter implementation leading to flight and operations.

1.2.1 Notice of Intent

In order to plan for a timely and efficient peer review process, NASA strongly encourages all prospective Step-One proposers to submit a Notice of Intent (NOI) to propose on or before the date specified in Section 1.5 in this AO. The submission of a NOI is not a commitment to submit a proposal, nor is information contained therein considered binding on the submitter. NOI's can be submitted in one of the following three ways although the Internet is the preferred.

1. Via Internet: enter the requested information through
SYS-EYFUS Web site located at <http://proposals.hq.nasa.gov/>.

2. By mail to: ESSP AO
NASA Peer Review Services, Code Y
500 E. Street, SW Suite 200
Washington, DC 20024-2760

3. By fax to: (202) 479.0511

Principal Investigators whose investigation teams include foreign institutions shall submit their NOI to the same address. In cases where investigators or team members from foreign institutions are to participate, their names, address and affiliations shall be included in the NOI, even if the details of their participation cannot be formalized by the deadline for receipt of the NOI. NOI's shall be typewritten in English.

User identifications (User ID) and passwords are required by NASA security policies in order to access the SYS-EYFUS Web site. Prospective PI's can check if they have a SYS-EYFUS UserID and Password by going to <http://proposals.hq.nasa.gov/> and performing the following steps:

- Click the hyperlink for new user, which will take the user to the Personal Information Search Page.
- Enter the user's first and last name. SYS-EYFUS will search for a matching record information in the SYS-EYFUS database.
- Confirm personal information by choosing the record displayed. (If the information is incorrect, follow the instructions below.)
- Select continue, and a User ID and password will be emailed to you.

Prospective PI's that are not in the SYS-EYFUS database (or whose Personal Information is incorrect) can obtain a UserID and Password by adding themselves to SYS-EYFUS by following the on-line instructions. In addition to adding general contact information, areas of interest and expertise are required. The final step is to create a UserID and Password. With the User ID and Password, login to the SYS-EYFUS Web site and follow the instructions for new Notice of Intent.

As a minimum, the following information will be requested for the NOI:

- AO number;
- A list of names, mailing address, phone number, and email address for the following:
Principal Investigator;
Co-Investigators;
Lead representatives from each organization included in the mission team.
- a descriptive title of the intended investigation; and,

- a brief (200-300 word) description of the investigation to be proposed, plus the NOI release notice (see Special Notice below.)

Note that any Co-Investigators, Collaborators, and/or Industrial Partners must obtain a User ID and password in order to be added to an NOI submitted via the Web. Since the information submitted to the SYS-EYFUS Web site is validated before being officially added to the database, new users should allow two weeks for this validation to occur.

A separate NOI must be submitted for each intended proposal. Note that the NOI may also be the preliminary version of the proposal Cover Page. If so, the Web site provides the user future use in updating this information for the final Cover Page as the deadline for submission of the final proposal approaches.

SPECIAL NOTICE: As a result of recent AO's for complete mission investigations such as this one, commercial aerospace and technology organizations have requested access to names and addresses of those who submit NOI's in order to facilitate informing potential proposers of their services and/or products. As an experiment and at the option of the submitters of an NOI, NASA ESE is willing to offer this service with the understanding that the Agency takes no responsibility for the use of such information. Therefore, all those submitting an NOI in response to this AO are requested to include the appropriately edited form of the following material at the bottom of the investigation abstract on the NOI:

“By submitting this Notice of Intent to propose, I hereby do / do not authorize NASA to post my name and institutional address (but not the name of my intended proposal) on the World Wide Web starting approximately one week after the NOI due date. If I do authorize such a posting, I understand that such information will be in the public domain, and I will not hold NASA responsible for any use made by others for revealing this information.”

1.2.2 Cover Page

A proposal Cover Page is required as part of the proposal, but will not be counted against the page limit. The cover sheet must be signed by the Principal Investigator and an official, by title of the investigator's organization, who is authorized to commit the organization.

The proposal Cover Page **may** be submitted electronically to the SYS-EYFUS Web site located at <http://proposals.hq.nasa.gov/>. If the proposer has submitted an electronic NOI to SYS-EYFUS, the same User ID and password can be used to complete the electronic proposal Cover Page. SYS-EYFUS will allow the user to copy the NOI information into the proposal cover page to update as necessary.

Prospective PI's can check if they have a SYS-EYFUS UserID and Password by going to <http://proposals.hq.nasa.gov/> and performing the following steps:

- Click the hyperlink for new user, which will take the user to the Personal Information Search Page.

- Enter the user's first and last name. SYS-EYFUS will search for a matching record in the SYS-EYFUS database.
- Confirm personal information by choosing the record displayed. (If the information is incorrect, follow the instructions below.)
- Select continue, and a User ID and password will be emailed to the user.

Prospective PI's that are not in the SYS-EYFUS database can obtain a UserID and Password by adding themselves to SYS-EYFUS by following the on-line instructions. In addition to adding general contact information, areas of interest and expertise are required. The final step is to create a UserID and Password. Once the PI has received the User ID and Password, login to the SYS-EYFUS Web site and follows the instructions for New Proposal Cover Page.

As a minimum, the following information is required:

- AO number;
- The name, mailing address, phone number, and email address for the following:

Principal Investigator;

Official by title of the investigator's organization who is authorized to commit the organization;

- PI and Authorizing Official signatures.

A hard copy version of the Cover Page submitted via the Web must be printed in time to acquire signatures and be included with the original hard copy of the proposal for delivery according to the AO schedule. Proposers are advised that they must not reformat the Cover Page after it is printed, as important NASA-required documentation may be lost. Proposers without access to the Web or who experience difficulty in using this site may contact the Help Desk at proposals@hq.nasa.gov (or call 202-479-9376) for assistance; or they may submit a Cover Page in a format that includes the required information listed above. **Please note that submission of the electronic Cover Page does not satisfy the deadline for proposal submission.**

1.2.3 Pre-proposal Conference

A pre-proposal conference will be held on the date listed in Section 1.5. The purpose of this conference is to address questions about the proposal process. The pre-proposal conference will address all those questions received by the Program Executive via the Internet at the ESSP-3 AO Internet site (<http://essp.larc.nasa.gov/essp>), via mail or via fax up until close of business, June 6, 2001.

Mail address:

ESSP AO NASA Peer Review Services, Code Y
500 E. Street, SW Suite 200
Washington, DC 20024-2760

FAX number: (202) 479.0511

Additional questions submitted after this date, including those provided in writing at the pre-proposal conference, may be addressed at the conference if time permits. NASA will prepare and post on the ESSP-3 Internet site an "AO Pre-proposal Conference Question Transcript" approximately two (2) weeks after the conference. The conference will be held June 14, 2001 at the Sheraton Crystal City in Arlington VA from 9:00 am to 3:00 p.m. Additional information concerning the pre-proposal conference is available on the Internet at: <http://essp.larc.nasa.gov/essp>. Those without Internet access may request this information from the address shown above.

Individuals planning to attend the pre-proposal conference are requested to provide notice to the following address:

ESSP AO NASA Peer Review Services, Code Y
500 E. Street, SW Suite 200
Washington, DC 20024-2760

or via the ESSP-3 AO Internet site (<http://essp.larc.nasa.gov/essp>).

Please provide the number of persons attending and the names, addresses and organizational affiliations of the attendees. This information shall be received by no later than one week before the conference in order to facilitate logistical planning.

1.2.4 Two Step Proposal Process

The proposal review process is divided into two distinct evaluation steps leading to selection. Proposers responding to this AO **shall** first submit a Step-One Proposal with emphasis on the planned science/applications investigation, measurement approach, instrumentation and technical maturity. The Step-One Proposal will be reviewed in accordance with the evaluation criteria in Section 5.1. Evaluation of the Step-One Proposal is intended to assess the in-depth scientific/applications merits, justification, and the maturity of the proposed mission in relation to the science/applications priorities, goals and objectives of the Earth System Science Pathfinder (ESSP) Project and the Earth Science Enterprise (ESE). Ratings will be determined for each Step-One Proposal and provided to the proposer. Based on the Step-One rating, NASA will recommend whether or not a proposer should submit the more detailed Step-Two Proposal. Each recommended proposer will be provided with an assessment of the proposed scientific/applications investigation, along with a high-level technical risk assessment of the mission implementation approach, before submittal of a full Step-Two proposal. No debriefing will be provided until after completion of Step-Two. NASA intends to recommend only a limited number of highly rated investigations to proceed to Step-Two. Missions not recommended to proceed to Step-Two are not prohibited from preparing Step-Two proposals, but should be aware that their proposed investigation has lower science/applications priority in Step-Two than those recommended to proceed.

Those proposers recommended in Step-One (and those who may choose on their own to continue with the AO process) will then be required to submit additional information in the form of a Step-Two Proposal by the date identified in Section 1.5. This proposal shall contain detailed science/applications, technical, cost, management, education and other opportunity information. The Step-Two Proposal will be evaluated in accordance with the evaluation criteria in Section 5.2. NASA will consider only those proposals whose science/applications objectives and methodologies have been evaluated in Step-One. Any proposal whose objectives or methodologies have significantly changed from Step-One **will not be considered** in Step-Two. NASA will make selections for formulation based on the combined Step-One and Step-Two evaluations as described in Section 5. Those selected in the Step-Two evaluation process will receive contracts to perform mission formulation, including risk reduction efforts, with an option to proceed into implementation for future flight. The mission formulation phase leading to MDR will be 12 months. After formulation, Preliminary Design Review (PDR) and MDR, NASA will select those missions that best meet the goals and objectives of ESSP and ESE to proceed with the Mission Confirmation Review (MCR) process (see Appendices D and H), leading to implementation and eventual flight. As part of the MCR, NASA will assess the funding required for the selected missions against the available profile, and may negotiate any adjustments in mission schedule and launch, and their associated cost impacts, as necessary. Risk retirement, mission maturity, and results of the MDR will be among the factors in determining which missions will be selected to proceed. Investigations not selected for implementation will receive no additional funding and will be terminated at the end of the formulation phase. Investigations not selected may be re-proposed in response to a future AO.

1.2.5 Earth System Science Pathfinder-3 AO Library

The ESSP-3 AO Library is a resource that was created to provide requirements and background information on the ESSP-3 AO and project, including science/applications goals, technology and education/outreach strategies, background information on management aspects of flight programs, safety, and launch services. However, it **does not contain** everything that may be required to develop a proposal. It is the responsibility of the PI to ensure all documents needed are obtained and are the current version. A listing of the contents of the ESSP-3 AO Library is contained in Appendix B. Additional information on the ESSP can be found at <http://essp.gsfc.nasa.gov/library.html>.

1.2.6 Notice to Offerors

In the event that a Principal Investigator employed by NASA is selected under this AO, NASA will award prime contracts to non-Government participants, including co-investigators, hardware fabricators, and service providers, who are named members of the proposing team, as long as the selecting official specifically designates the participant(s) in the selection decision. Refer to Appendix K, Section L of this AO for proposal information that the selecting official will review in determining whether to incorporate a non-Government participant in the selection decision. Each NASA contract with hardware fabrications and service providers selected in this manner will be supported by an appropriate justification for other than full and open competition, as necessary.

1.3 Commercial and Operational Endeavors Provision

Both national and NASA policy require NASA to support private-sector investment in commercial space activities by committing the U.S. government to purchase commercially available goods and services. In addition, NASA's policy is to work with the private sector, other U.S. government agencies and our international partners in the development of a comprehensive capability to observe and understand the Earth. For selected science missions where it can be demonstrated that the data has potential commercial value, NASA is willing to negotiate the data/information rights with interested parties on a case-by-case basis. NASA may also purchase commercial data whenever the commercial data are cost effective and meet NASA's requirements, rather than develop a mission that produces comparable data.

If at the time of proposal evaluation, there is a likely or approved measurement capability similar to that proposed, these policies would preclude selection of that proposal. NASA will select a mission only if the proposer can demonstrate that the proposed mission can deliver science data that does not compete with or duplicate other capabilities. For missions that are similar to existing or planned capabilities, NASA recommends that the proposal include documentation, such as a letter of support, from an appropriate entity responsible for the existing or planned capability indicating their support and agreement that the proposal complements and does not compete with their capability.

Consistent with NASA and national policy, NASA encourages partnership proposals that share investments and benefits. For all such arrangements, NASA will treat the commercial aspects of the mission as contributed capabilities and will evaluate and assess the likelihood of success for the entire mission consistent with the requirements and evaluation criteria described in Sections 3 and 5. For commercial partnerships, these arrangements could include:

- data buy agreements,
- Government financed improvements to commercial systems (e.g., improved calibration, increased storage and downlinking capability),
- shared development of the mission, or
- independent but complementary Government and commercial missions with data sharing agreements.

1.4 Scientific/Applications and Technical Inquiries

Inquiries of a scientific/applications, technical or programmatic nature shall be directed to the ESSP Project Coordinator.

By mail to:

ESSP AO NASA Peer Review Services, Code Y
500 E. Street, SW Suite 200
Washington, DC 20024-2760

Internet at:

The on-line forum to submit and discuss scientific, technical or programmatic issues and inquiries can be found on the Internet at ESSP-3 AO Internet site (<http://essp.larc.nasa.gov/essp>).

1.5 Proposal Opportunity Period and Schedule

The opportunity described here is for a two step proposal selection cycle, according to the nominal schedule shown below:

Date of AO release	May 18, 2001
Pre-proposal Conference	June 14, 2001
Notices of Intent due	June 22, 2001
Step-One Proposals due	July 20, 2001
Release of Step-One ratings	September 7, 2001
Step-Two Proposals due	January 11, 2002
Foreign Letters(s) of Endorsement due	February 8, 2002
Planned Site Visits	February, 2002
Announcement of Step-Two selections	March, 2002
Preliminary Design Review/ Mission Design Review.....	March, 2003
Missions selected to proceed.....	April, 2003
Confirmation Readiness Review.....	May, 2003
Mission Confirmation Review.....	June, 2003

2.0 RESEARCH OBJECTIVES

2.1 Programmatic Context

The mission of NASA's Earth Science Enterprise (ESE) is to develop a scientific understanding of the Earth system and its response to natural or human-induced changes, thereby improving the predictive capabilities for climate, weather, and natural hazards. Through its science research programs, the ESE aims to acquire a deeper understanding of the components of the Earth system and their interactions. These interactions occur on a continuum of spatial and temporal scales ranging from local and regional to global scales and from short-term weather to long-term climate scales. The Enterprise also seeks to provide accurate assessments of changes in the chemical composition and physical state of the atmosphere; in the extent and health of the world's forest, grassland, and agricultural resources; and in geologic phenomena that lead to natural hazards.

NASA shares with other US Global Change Research Program (USGCRP) partners an interest in fundamental studies of the basic processes that govern the Earth system, diagnostic studies of recent and past satellite data records, and model simulations/predictions of global changes. At the same time, effective use of resources requires that the ESE's science strategy be focused on

research projects that allow optimal use of NASA's unique capabilities. Compared to the range of investigations embraced by the entire USGCRP, NASA's Earth science program emphasizes measuring changes in forcing parameters, and documenting the natural variability of the Earth system and responses to forcings, especially through space-based measurements. Space-based measurements can provide global coverage, high spatial resolution, and/or temporal resolution, in combinations that cannot be achieved by conventional observational networks.

The *Research Pathways* report (NRC, 1999a) formulated a wide range of research imperatives and scientific questions that require investigation across the field of Earth system science. Choosing among all potentially important research questions is a judgment of scientific value. In the context of NASA's Earth science research program, the principal scientific priority criteria are the spatial scale, temporal duration, and the nature and magnitude of the phenomena being investigated, as well as anticipated return in terms of reducing the uncertainty in understanding and documenting potential changes in the Earth system.

Research questions that address Earth system dynamics at ***large regional to global scales*** are those of greatest interest for the ESE. This is particularly true for regions where only limited conventional (non-space) observations are available (e.g., the atmosphere over the open ocean and polar regions, continental ice sheets, etc.). For example, ESE's atmospheric chemistry research has been focused on global scale chemical processes rather than local air quality, which is typically the responsibility of regulatory environmental agencies.

Likewise preference is given to the study of phenomena and processes that may induce lasting changes in the Earth system, typically ***seasonal and longer period responses***, as well as changes that are irreversible in the foreseeable future. Understanding and predicting fast processes (e.g., the development of weather systems, trace gas emissions) may be essential in order to quantify longer-term average impacts. While forecasting individual environmental phenomena is not a primary ESE objective, further developing experimental prediction of specific events (e.g., weather disturbances) that can be verified by observation is a fundamental research tool for understanding changes in climate and the global environment (e.g., mean displacement in storm tracks). At the process level, priority is given to those processes that have the potential to induce ***large impacts*** and/or are the root of large uncertainty in the overall response of the Earth system.

NASA is a research and development agency, dedicated to maintaining leadership in space research, technology, and missions. Common to all NASA Enterprises is the objective of introducing technical innovations in sensor and platform design, and integrating these new capabilities in flight mission programs. Although not the place to develop new technology, NASA's research and development mission guarantees a strong commitment to expanding knowledge of the Earth through new types of global environmental observations. Investigators seeking to develop new technologies or whose mission concepts do not meet the mission readiness constraint described in section 3.1.2 are encouraged to consider proposing to NASA technology development competitions, such as those for the New Millennium Program (NMP) or the Instrument Incubator Program (IIP).

NASA initiated the Earth System Science Pathfinder (ESSP) project to provide a flexible opportunity to stimulate new scientific understanding of the global Earth system by encouraging

innovation in instrumentation and strategies for acquiring and distributing new datasets. The program seeks to reward creativity in all aspects of mission development and to encourage increased participation and innovative ideas in studies of interactions of components of the Earth system and in measurements of key variables from space. The philosophy behind ESSP embraces small satellite missions addressing high priority Earth System Science objectives where the scientific focus of the program will naturally evolve with our enhanced understanding.

ESSP is a science-driven project intended to identify and develop low-cost, quick turnaround spaceborne missions. The National Academy of Sciences (NAS) recommended that ESSP pursue scientific objectives that are not being directly addressed by current or approved programs (NAS/NRC document FO-2080, 1995). As such the ESSP Project is intended to address exploratory measurements which can yield new scientific breakthroughs and can deliver conclusive scientific results addressing a focused set of scientific questions. In some cases, this may involve measuring several related parameters to allow closure tests to be carried out. In other cases, an exploratory mission may focus on a single pioneering measurement that opens a new window on the behavior of the Earth system.

It is the goal of the ESSP Project to sustain a launch rate of at least one mission per year. As such, ESSP will provide periodic windows of opportunity to accommodate new scientific priorities by conducting a series of focused missions to answer critical Earth System Science questions not currently addressed NASA's Earth Science Enterprise. By conducting ESSP missions on a regular basis, NASA provides a mechanism to continuously enhance Earth Science and Applications Programs that are evolving based on new knowledge and changing national priorities.

2.2 Scientific Questions

Establishing research priorities becomes a major challenge when priorities cross a number of different disciplines, each embracing a large set of scientific questions. The challenge facing the ESE is to balance competing demands in the face of limited resources and chart a program that addresses the most important and tractable scientific questions and allows optimal use of NASA's unique capabilities for global observation, data acquisition and analysis, and basic research. To this end, choices need to be made between many projects, all of which are important, timely, and ready to succeed. Most significant from a strategic perspective are the choices between different but equally promising candidate space flight missions or measurement systems.

Thus, NASA's selection of priorities involves both scientific needs and implementation realities. Scientific considerations are paramount and start the prioritization process. These considerations determine what science questions, and ultimately which missions and research projects shall be pursued. Purely scientific considerations are followed by considerations of science-related context (e.g., benefit to society, mandated programs), followed in turn by implementation considerations. The latter, such as technology readiness, tend to influence the order in which science projects are pursued and the final shape they may take. These practical considerations often result in some feedback and iteration of project selection.

Thus, the strategy for this ESSP AO is to solicit unique Earth Science missions that address one or more of the unanswered science questions in the *NASA Earth Science Research Strategy for 2000-2010* http://www.earth.nasa.gov/visions/researchstrat/Chap1_Research_Strategy.htm

The key research topics studied by NASA's Earth Science Enterprise fall largely into three categories: forcings, responses, and the processes that link the two and provide feedback mechanisms. This conceptual approach applies to all research areas of NASA's Earth Science program. The Research Strategy to address this complex problem is laid out in five fundamental questions, each raising a wide range of cross-disciplinary science problems.

- *How is the global Earth system changing?*
- *What are the primary forcings of the Earth system?*
- *How does the Earth system respond to natural and human-induced changes?*
- *What are the consequences of change in the Earth system for human civilization?*
- *How well can we predict the changes to the Earth system that will take place in the future?*

While these five questions define a logical progression in the study of the Earth system, each one covers a range of topics too broad to serve as a simple guide for program implementation. For this purpose, more specific research questions need to be formulated and prioritized. The ESSP Project is designed to both complement and extend the existing ESE flight program strategy. This third ESSP AO seeks to address the following Earth science research priorities and associated questions based on a logical progression of our current understanding.

Earth System Variability and Trends

- How are global precipitation, evaporation, and the cycling of water changing?

Primary Forcings of the Earth System

- What trends in atmospheric constituents and solar radiation are driving global climate?
- How is the Earth surface being transformed, and how can this information be used to predict future changes?

Earth System Responses and Feedback Processes

- What are the effects of clouds and surface hydrologic processes on climate change?
- How do ecosystems respond to and affect global environmental change and the carbon cycle?
- How can climate variations induce changes in the global ocean circulation?
- How do stratospheric trace constituents respond to change in climate and chemical composition?
- How is global sea level affected by climate change?

- What are the effects of regional pollution on the global atmosphere, and the effects of global chemical and climate changes on regional air quality?

NASA will consider scientifically compelling proposals based on other scientific questions, but proposers shall provide a clear and concise justification in the Step 1 proposal.

These research priorities encompass the traditional disciplines of atmospheric chemistry and physics, solid Earth, oceans and ice, ecosystems, natural hazards, and applications, and are intended to impart a problem focus on the satellite observational activities conducted under the aegis of NASA's Earth Science Enterprise.

The initial ESSP Announcement of Opportunity emphasized scientific investigations within all areas of Earth System Science. However, the offerors had to demonstrate that the proposed investigations complemented NASA's existing and/or approved flight program, which was largely embodied by the Earth Observing System (EOS). Further, it was intended to encourage missions which could serve as either gap-fillers or which could provide new types of global "foundation" datasets. The second ESSP Announcement of Opportunity reflected the approaching launch of the initial EOS missions and the continuing development of the missions selected in the first ESSP AO. While not precluding innovative proposals for missions that address critical issues in areas for which there are approved flight programs, the second AO sought unique missions that demonstrate a scientific focus clearly beyond the scope of existing programs.

This ESSP Announcement of Opportunity seeks unique missions that demonstrate a scientific focus on priority areas identified above and are clearly beyond the scope of existing and/or approved missions. NASA will consider proposals based on other compelling scientific questions/priorities, however it remains up to the proposers to articulate the overall scientific benefit of any missions that seek to improve upon planned measurement sets.

ESSP missions are intended to be science-driven. Proposers are required to quantify how the new observations will contribute to the state of knowledge toward one or more chosen science questions by means of a sensitivity analysis that illustrate the anticipated improvements in the state of knowledge/understanding as a result of reductions in uncertainty, and a Science Traceability Matrix (see Appendix L, Fig. L-3).

The NASA Earth Science Enterprise integrates a broad suite of observational and monitoring objectives in the context of the USGCRP. Specific program elements are summarized in several key science documents (see Appendix B: "Contents of the ESSP-3 AO Library").

The following Internet World-Wide-Web Homepages (URL addresses) may provide additional information of interest:

NASA Earth Science Enterprise Homepage: <http://www.earth.nasa.gov/>

NASA ESE Missions: <http://www.earth.nasa.gov/missions/index.html>

ESSP Project Homepage: <http://essp.gsfc.nasa.gov>

ESSP-3 Announcement of Opportunity Homepage <http://essp.larc.nasa.gov/essp>
EOS Project Office Homepage: <http://eospsos.gsfc.nasa.gov/>
NASA's New Millennium Program: http://nmp.jpl.nasa.gov/index_flash.html

In summary, the ESSP Project is designed to augment the global measurement objectives of the USGCRP as well as other strategic Earth Science objectives outlined by the National Academy of Sciences. As such, the ESSP Project seeks to:

- Provide new observations that will contribute to the state of knowledge toward one or more chosen science questions
- Provide space based measurements complementary to those directly supported by the NASA Earth Science baseline missions (i.e., EOS and Earth Probes observational data sets)
- Avoid duplicating observational objectives currently supported by means of existing NASA Earth Science Missions (e.g., GRACE, CloudSat, PICASSO-CENA)
- Avoid duplicating observational objectives supported by existing or approved commercial, national, or international global Earth Science Missions (e.g., Ikonos, POES, GOES, ADEOS II, ALOS, ENVISAT, METOP)

2.3 Announcement Objectives

This AO invites proposals for the next set of ESSP missions. The objective of this opportunity is to select the two or three missions that comprise the next mission set and to fund them through implementation, launch, and science data archival and dissemination. Proposals are invited for complete investigations of significant Earth System Science questions that meet the objectives of the NASA Earth Science program defined above.

Only proposed investigations that lead to complete flight missions including archival and dissemination of data to the scientific community will be accepted. Proposals describing only portions of a mission will be deemed not responsive to the AO and will be returned to proposers prior to evaluation. Proposers must address how all elements of the complete mission will be accomplished. Even if elements of the proposed mission are contributed in a partnership arrangement, or are made available at no cost to ESE as in a secondary payload agreement, or are commercially provided, as in a data buy arrangement, these elements must be described in the proposal to allow NASA to assess the risks of successful implementation and delivery of the data. NASA will evaluate all aspects and elements of the mission against the criteria in this announcement.

3.0 PROGRAM CONSTRAINTS, GUIDELINES AND REQUIREMENTS

For ESSP missions, the responsibility and authority to implement the mission rests with the Principal Investigator (PI) and the team that he/she chooses to support him/her. Consistent with

the past ESSP missions, the PI's team will have a large degree of freedom in accomplishing mission objectives within the stated constraints. However, to promote teamwork between the PI's team and NASA and to ensure mission success, there will be appropriate Government oversight and insight. Once a mission has been selected, failure to maintain satisfactory progress on an agreed to schedule or failure to operate within the constraints outlined below may be cause for termination of the investigation by NASA.

Every aspect of the proposed mission shall reflect a commitment to mission success, while conserving total mission costs. Each component of a proposed mission, from the mission design to the selection of the launch service, to the approach to mission operations, will be evaluated on that basis. Consequently, missions shall be designed and scoped to emphasize mission success within cost and schedule constraints by incorporating sufficient performance margins, cost and schedule reserves, and content resiliency via descoping options.

Only those missions whose scientific objectives are deemed of highest priority, with an acceptable implementation risk, and whose proposed implementation cost and definition/development schedules are within the constraints and guidelines identified herein will be considered as candidates for selection. NASA encourages and favors low cost missions that can demonstrate high science value in order to enable more frequent and diverse missions.

NASA's Earth Science Enterprise has adopted commercial data purchases as a mainstream way of acquiring research-quality data, as these commercial capabilities become available. NASA encourages the use of commercially available data sets by PI's as long as it meets the scientific requirements and is cost-effective. If applicable, the proposer shall identify the commercial data sources intended for use and the associated cost. If a data buy is proposed all sources will be evaluated as if it is a proposed mission consistent with the evaluation criteria in Section 5.

The following sections describe the constraints, guidelines and requirements for missions selected through this announcement. Specific information, directions, and requirements for Step-One and Step-Two proposal preparation and evaluation are included in Sections 4 and 5 and Appendix K.

3.1 General Program Constraints

3.1.1 Available Funding

The ESSP represents an effort by NASA to develop and implement a program of small, frequent, high-value Earth science/applications missions. To this end, NASA funding for the mission(s) selected under this AO is limited. NASA encourages but does not require contributions from sources other than NASA. NASA has no limit on the size of the contributions, but will assess the contributed aspects of the proposal against the same criteria as the NASA funded aspects.

For each proposed mission, the NASA Earth Science Enterprise Cost ceiling is \$125 million in real year U.S. dollars, including schedule and budget reserves and formulation costs through MCR Process, but not including the NASA Earth Science Launch Service Cost. The Step-Two proposal shall include a commitment by the proposer to accomplish the mission within the

proposer's Earth Science Enterprise Cost cap, which shall be less than or equal to the ESE Cost ceiling. The proposed NASA Mission Cost (NMC) is the sum of the proposed NASA Earth Science Enterprise Cost Cap and the proposed NASA Earth Science Launch Services Cost in real year dollars. The proposed Total Mission Life Cycle Cost is the sum of the proposed NASA Mission Cost (if any) and the cost of all proposed contributions in real year U.S. dollars. (See Appendix N for additional information on definition of terms.)

It should be noted that funds are not currently appropriated by the U.S. Congress for awards under this AO. The Government's obligation to make award(s) is/(are) contingent upon the availability of appropriated funds from which payment(s) can be made and the receipt of proposals that NASA determines are acceptable for award under this AO.

3.1.2 Mission Readiness

The ESSP provides a mechanism to accomplish important scientific/applications investigations within a reasonable development period. Therefore, all proposed missions shall be of sufficient technical maturity to achieve launch readiness within a goal of 36 months after receiving the authority to proceed into mission implementation. NASA has placed no absolute time constraint upon the duration of mission operations, although the proposal should provide the scientific/applications and cost-based justification of the proposed mission duration.

3.1.3 Mission Options

It is NASA's intention to give the proposing community broad flexibility in developing ESSP mission options. ESSP missions may use (1) data buy agreements, (2) NASA financed modifications to commercial systems, (3) payloads attached to the International Space Station (ISS), the Space Shuttle cargo bay, or to other spacecraft busses, or (4) free-flying spacecraft launched by expendable launch vehicles. The ISS opportunities include external attached payloads intended for the EXPRESS (EXpedite the PRocessing of Experiments for the Space Station) Pallet and internal pressurized payloads intended for the Window Observational Research Facility (WORF). EXPRESS Pallet opportunities are anticipated to be available in 2004 and 2005 and WOLF opportunities are anticipated to begin in 2002 or 2003. Investigations that propose to use the resources of the Space Shuttle and/or the ISS are responsible for working directly with the appropriate NASA field centers to obtain a flight manifest, and providing the necessary resources to support payload integration and safety activities. The proposer should bear in mind that no ESSP investigation will be launched as a free-flier from the Shuttle. For more information on ISS and the Space Shuttle refer to the ESSP-3 AO library at <http://essp.larc.nasa.gov/essp>.

NASA envisions a time when the majority of services required to implement missions are available in a "catalog" mode, leaving the investigator free to focus on the aspects of the mission that are unique to the scientific objectives. As steps towards this end, and to facilitate broad flexibility on the part of the community in developing ESSP mission options, NASA has made available a number of services. With the exception of NASA provided launch services, proposers are free to use all, some, or none of these services. The proposal must contain the

same level of detail in describing all aspects of the planned mission, whether aspects of the mission are obtained from NASA or from other sources.

As a service to the community, the Rapid Spacecraft Development Office (RSDO) provides a “catalog” of spacecraft buses. Use of RSDO services is at the discretion of the proposer. Further information on the RSDO is available through the ESSP-3 AO Library, Appendix B.

Tracking, control, communications, and other operations services are available through the Space Operations Management Office (SOMO). As a matter of NASA policy, proposers selected through this announcement should be prepared to support tradeoff studies on the use of NASA-provided operations services versus proposed alternatives, during the Mission Definition and Preliminary Design phase leading to the Mission Design Review. General NASA guidance is that NASA-provided operations services be employed whenever they meet mission objectives at a cost less than or equal to any proposed alternatives.

3.1.4 Launch Services

For the ESSP-3 AO, the Office of Earth Science decided that the Government would provide each selected ESSP mission with NASA funded launch services, selected by the PI from any NASA-certified launch vehicle costing up to \$50M. The decision to proceed this way was driven by NASA’s well-identified policies on mitigation of risks associated with launch vehicles. By providing the launch vehicle, NASA will make available to the PI the technical expertise and programmatic infrastructure at the Kennedy Space Center to provide the insight and oversight into the launch services. Currently there are three NASA launch vehicles that meet the criteria for selection.

- Taurus 2210
- Taurus 2110
- Pegasus XL

Funding for any of these launch services come from the NASA Earth Science Launch Services funds.

The selection of the launch vehicle does not get finalized until the Mission Confirmation Review (MCR) at the end of the formulation phase. For ESSP-3, MCR is anticipated to be in late Spring 2003, at which time other options within this class of launch vehicles may be available. During formulation, NASA reserves the right to investigate other launch vehicles and/or strategies. Therefore additional trade studies involving launch services may be required during formulation. Additional information about the current launch services available for ESSP is contained in Appendix C.

For the purposes of the proposal, the PI should select, from the three current choices, a launch vehicle that meets the requirements of the proposed mission. If none of the three meet the requirements, the PI is free to explore other launch service possibilities such as partnering, ride sharing, contributions, or using a different NASA-certified Expendable Launch Vehicle (ELV). The PI must understand that, with the exception of the NASA-certified ELV selection, he/she will receive no NASA Earth Science Launch Services funding for the alternatives. If the PI

selects the NASA ELV alternative, the mission will receive up to \$50M (real year Dollars) in Earth Science Launch Services funds. Cost over the \$50M threshold will be charged against the PI's NASA Earth Science Enterprise cap.

Please note that although NASA will fund the Government launch services separately, NASA Earth Science Launch Services Cost will be considered and evaluated as part of the total NASA Mission Cost. **All launch services shall be costed in the proposal whether funded by NASA or not.**

The following applies to contributed launch services. The National Space Transportation Policy states that for the foreseeable future, United States Government payloads will be launched on space launch vehicles manufactured in the United States, unless exempted by the President or his designated representative. The policy does not apply to the use of foreign launch vehicles on a no-exchange-of-funds basis for flights of scientific instruments on foreign spacecraft, international scientific programs, or other cooperative government-to-government programs. Such use will be subject to interagency coordination procedures. This exemption may not apply to all contributions of foreign launch services, such as contributions from private or commercial entities that are not subject to interagency coordination procedures. For example, a private U.S. company, seeking to contribute accommodation of an ESSP payload on an U.S. manufactured, privately owned commercial satellite, will need a waiver of this national policy if the launch vehicle is not manufactured in the United States.

If a proposal submitted in response to the ESSP AO requires that NASA consult with the Office of Science and Technology Policy regarding consistency with National Space Transportation Policy, NASA will not reject the proposal for this reason. If such a proposal is selected for funding, the NASA Office of Earth Science will request that the NASA Office of Space Flight initiate formal coordination with the White House Office of Science and Technology Policy (OSTP) regarding the proposed mission concept. However, NASA will not approve a mission for implementation without the OSTP discussion being complete on or before the time of the Mission Design Review. NASA cannot guarantee that OSTP concurrence will be provided for any given mission. In the event that a mission cannot be approved for implementation for this reason, the Government has no liability. The proposing team assumes the risk of submitting a proposal that is conditioned upon obtaining OSTP approval to use a foreign launch vehicle for NASA-funded payloads.

For more information on the National Space Transportation Policy, see the August 5, 1994 Fact Sheet - Statement on National Space Transportation Policy. This document can be accessed on the web site of the Office of Science and Technology Policy at <http://ostp.gov/NSTC/html/pdd4.html>

3.2 General Program Guidelines

For the purposes of this AO, mission phases are defined as follows:

Phase 1: Mission Concept Studies

Phase 2: Mission Definition and Preliminary Design

Phase 3: Mission Detailed Design

Phase 4: Mission Development and Launch

Phase 5: Mission Operations and Data Analysis, Archival, and Dissemination

Generally, Phases 1 and 2 occur during mission formulation while Phases 3, 4, and 5 are performed during mission implementation (See NASA Document NPG 7120.5).

3.2.1 Mission Teaming

ESSP mission teams shall be led by a **single** Principal Investigator from any U.S. organization including educational institutions, industry, nonprofit institutions, NASA Centers, Federally Funded Research and Development Centers (FFRDCs) and Government agencies. The PI is responsible to NASA for the scientific integrity of the mission, as well as the management of the complete mission. Teaming and partnership arrangements are encouraged. Co-Investigators (CoI) **shall** have an identified role in the proposal, play a defined and necessary role in the investigation, and be covered in the funding plan. Teams are encouraged to use U.S. commercial suppliers, commercial off-the-shelf technology, and other arrangements to support U.S. industry to the greatest extent practical.

If included in your proposal, NASA institutional services shall be proposed on a full-cost accounting basis through teaming arrangements between the mission team and NASA centers. In such cases, it is the team's responsibility to contact the appropriate NASA organization directly and provide endorsements from the NASA organization. The Office of the Chief Financial Officer at a NASA field center can provide assistance with full-cost accounting information. (Also see Appendix K, Section M.1.a.)

3.2.2 Contributions

Contributions of any kind, whether cash or non-cash (property and services) are encouraged but not required. There is no limit on the amount of contributions. Contributions are defined as any portion of a mission provided on a no-exchange-of-NASA-funds basis. Such contributions may be applied to any part, or parts, of a mission, and may be from U.S. companies, U.S. Government agencies, and/or international participants (see Section 3.3). For commercial partnerships, these contribution arrangements may include the commercially funded portions of data buy agreements, Government financed improvements to commercial systems to meet the Government's requirements, shared development of the mission, or independent but complementary Government and commercial missions with data sharing agreements. Costs for NASA Center civil service or support contractor resources (manpower, facilities or hardware) may not be contributed, unless they are being separately funded for an effort complementary to the proposed investigation.

Values for all contributions of property and services shall be established in accordance with applicable cost principles and included in the proposed Total Mission Life Cycle Cost (TMLCC), which is the sum of the NASA Mission Costs (NMC) and all contributions. The cost of contributed hardware shall be estimated as either (1) the cost associated with the development and production of the item if this is the first time the item has been developed and if the mission represents the primary application for which the item was developed; or (2) the cost associated

with the reproduction and modification of the item (i.e., any recurring and mission-unique costs) if this is not a first-time development. If an item is being developed primarily for an application other than the one in which it will be used in the proposed investigation, then it may be considered as falling into the second category (with the estimated cost calculated as that associated with the reproduction and modification alone). The cost of contributed labor and services shall be consistent with rates paid for similar work in the offeror's organization. The value of materials and supplies shall be reasonable and not exceed the fair market value of the property at the time of contribution.

NASA will assess the entire mission, including all contributions, against the criteria in this AO. Proposed contributions, including commercial partnership arrangements, shall be described in sufficient detail to allow an assessment of the adequacy of the contribution to fulfill the commitment made. This includes the provision of all requested technical, cost, schedule, and management data in the proposal and subsequent reviews. Failure to document all technical, cost and schedule data, management approaches and techniques, and the commitment of all contributing team partners, may cause a proposal to be found non-responsive to this AO and dropped from further consideration. If NASA selects a mission with domestic contribution arrangements, the appropriate agreements and/or contracts shall be signed and copies delivered to NASA within 90 days of award of NASA mission contract.

3.2.3 Data Dissemination

U.S. Government information shall be disseminated without restriction at no more than the cost of dissemination. Therefore, data from ESSP Missions funded by the U.S. Government will be distributed in the same way as other NASA Earth Science Enterprise data (see Section 3.4). However, for data from missions in which there is significant U.S. private sector investment, NASA will consider innovative data management approaches that afford protection of commercial opportunities while still maximizing non-proprietary scientific return. In all cases, the mission science team approved by NASA shall have immediate and complete access to the basic data and products defined and produced by the mission. NASA will consider proposals for non-traditional data distribution arrangements as long as the full data set is ultimately available for long-term archival and open distribution. For data/information having demonstrated commercial value, however, NASA is willing to consider special arrangements on a case-by-case basis.

3.3 Foreign Participation

Recognizing the potential scientific/applications, technical, and financial benefits offered to all partners by foreign participation, participation by foreign individuals and organizations as CoI's or team members in ESSP investigations is welcomed. Participation by foreign partners in ESSP missions may include the contribution of all, or a portion of, the scientific/applications instruments, spacecraft, launch services (subject to national Policy constraints), mission operations, mission science (i.e., science/applications team), communications, data processing, etc., on a no-exchange-of-NASA-funds basis. Any proposed foreign entities shall be described at the same level of detail as that of other partners. This includes the provision of all requested cost, schedule, and management data in the proposal and subsequent reviews.

The direct purchase of goods and/or services from foreign sources by U.S. team members is permitted but is subject to federal trade laws and regulations. Potential ESSP participants are advised that international purchases made using funds derived from NASA shall meet NASA and Federal regulations and that these regulations will place an additional burden on investigation teams that shall be explicitly included in discussions of the investigation's cost, schedule, and risk management. Information regarding regulations governing the procurement of foreign goods or services is provided in Appendix E.

Proposals from U.S. entities that include foreign participation must have the endorsement of the respective government agency or funding/sponsoring institution in the country from which the foreign entity comes. See Section 4.2.1 of this AO for additional information on endorsements.

Should a U.S. proposal with foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the foreign sponsor will each bear the cost of discharging their respective responsibilities. Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

- (i) An exchange of letters between NASA and the foreign sponsor; or
- (ii) A formal Agency-to-Agency Memorandum of Understanding (MOU).

Proposals including foreign participation must include a section discussing compliance with U.S. export laws and regulations, e.g., 22 CFR Parts 120-130 and 15 CFR Parts 730-774, as applicable to the circumstances surrounding the particular foreign participation. The discussion must describe in detail the proposed foreign participation and is to include, but not be limited to, whether or not the foreign participation may require the prospective proposer to obtain the prior approval of the Department of State or the Department of Commerce via a technical assistance agreement or an export license, or whether a license exemption/exception may apply. If prior approvals via licenses are necessary, discuss whether the license has been applied for or if not, the projected timing of the application and any implications for the schedule. Information regarding U.S. export regulations is available at <http://www.pmdtc.org> and <http://www.bxa.doc.gov>. Proposers are advised that under U.S. law and regulations, spacecraft and their specifically designed, modified, or configured systems, components, and parts are generally considered "Defense Articles" on the United States Munitions List and subject to the provisions of the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120-130.

3.4 Science/Applications Requirements

Proposals submitted in response to this AO shall cover the entire mission. This includes definition, development, launch, mission operations, necessary in situ measurements, data processing, data archival, dissemination of data into the public domain, and preparation of adequate documentation and ancillary data for analysis by scientists other than those participating in the prime mission phase. All ESSP missions shall comply with the guidelines outlined in Appendix G, in order to ensure timely community-wide access to reduced data products. As such, there will be no proprietary data rights allowed, except as discussed in

Section 3.2.3. ESSP mission teams will be responsible for collecting the scientific/applications, engineering, and ancillary information necessary to validate and calibrate the scientific/applications data before making it available to the scientific/applications community and, ultimately, the public. The ESSP mission evaluation process will reward those proposals that outline procedures for minimizing the time between data acquisition and data dissemination.

ESSP PI's are required to publicize their products and data services to the broader Earth Science community via the Global Change Master Directory (GCMD). PI's will ensure population of the GCMD with appropriate information on their instrument and data products and services, and provide pointers to their World Wide Web (WWW) page or other client interface for search and access. All data set descriptions should be provided as Directory Interchange Format (DIF) entries, which are automatically compliant with the Federal Geographic Data Committee (FGDC) standard for geospatial data. The content for DIFs can be easily submitted through the DIFbuilder tool, available at <http://gcmd.nasa.gov/difbuilder>. Descriptions for related data tools or services should be provided as Services Entry Record File (SERF) entries, for which the content can be submitted through the SERFbuilder tool, available at <http://gcmd.nasa.gov/serfbuilder>. Contact the GCMD User Support Office at http://gcmduso@gcmd.nasa.gov/ for assistance.

To facilitate access to ESSP data by the Earth Science community, NASA recommends that ESSP missions produce data products in a core NASA-provided or community-endorsed format compatible with the research community that will use the data. NASA also recommends that ESSP missions generate and store metadata describing their data products that will facilitate user search and order, and user understanding of product quality and utility. Further information on data archival and access, and on data and metadata standards, is found in Appendix G.

In addition to the available funding described in Section 3.1.1, NASA intends to allocate resources to solicit and award post-launch Science Data Analysis projects (SDAP) for broad scientific studies of the Earth using newly generated ESSP data sets. As an ESSP mission nears launch, and periodically thereafter, NASA will solicit proposals for investigations under the SDAP via NASA Research Announcements (NRA's).

ESSP mission science/applications teams shall succinctly define the scientific/applications objective of the proposed mission and the scope of their efforts for the active data collection phase of their mission. It is anticipated that the PI and his/her team will focus their efforts on data acquisition, calibration, validation, and initial scientific/applications evaluation in support of their proposed research objective(s). The follow-on SDAP, which will be open to all parties interested in ESSP mission data sets, will focus upon additional interpretation and correlative analysis activities. While the ESSP mission team is encouraged to analyze and publish interpretations of mission flight data as it becomes available during the course of the active mission, it shall be understood that community-wide analysis of the reduced (i.e., validated and calibrated) data sets provided by each ESSP mission will be largely supported by the follow-on SDAP. Therefore, the selected ESSP mission team members shall have clearly defined roles during the pre-flight development and flight mission data acquisition, calibration, validation, and initial scientific evaluation activities.

Some ESSP missions may require supporting suborbital remote sensing under flights and ground calibration activities. NASA recognizes that these can be critical elements of overall ESSP missions and, if required, they should be fully described and costed in proposals submitted in response to this AO.

Every ESSP mission proposed in response to this AO **shall** identify both a “Baseline Science/Applications Mission,” a “Minimum Science/Applications Mission,” and an associated descope plan. The Baseline Mission refers to that mission which, if fully implemented, will accomplish the entire set of scientific/applications measurement objectives identified for the mission at the initiation of formulation. The Minimum Mission is defined as the minimum science/applications accomplishment (i.e., measurement set) below which the mission will not be considered justifiable for the proposed cost.

Any alteration of the mission that results in a reduction of the mission's ability to accomplish the Baseline Mission set of scientific objectives as identified at the Step-Two award will be considered a “de-scoping” of the mission. NASA and the PI will review the resulting set of achievable scientific/applications objectives to ensure that the mission remains at or above the Minimum Mission. The peer review and technical evaluation of Step-Two proposals will determine the science/applications return of both the Baseline and Minimum Missions. The differences between the proposed Baseline and Minimum Missions will be assessed in the Step-Two process to determine mission resiliency in the event that development problems require reductions in scope. If the proposed Baseline and Minimum Missions are equivalent, proposers shall clearly articulate the rationale for this decision and identify other viable contingency options in the Step-Two proposal (i.e., additional reserves, etc.). Failure to maintain a level of anticipated science/applications return at or above the Minimum Mission, as determined by NASA, will be cause for termination of the investigation at any time.

3.5 Technical Requirements

ESSP proposals shall include all technical aspects of the investigation from concept definition through mission operations and data analysis, archival, and dissemination (See Section 3.2). ESSP missions shall meet the technical requirements described in the Earth Explorers Program Mission Assurance Guidelines and Requirements and the Earth Explorers Program Flight and Ground Safety Requirements (see Appendices H and J). Each mission shall be responsible for performance of the required orbital debris assessment as defined in Section 2.0 of Appendix J. NASA Procedures and Guidelines (NPG) 7120.5 (“Management of Major System Programs and Projects”) delineates activities, milestones, and products typically associated with mission formulation and implementation and may be used as guidance in defining a team's mission approach. The use of innovative processes, techniques, and activities as well as direct purchase of commercial off-the-shelf (COTS) technology to accomplish objectives is encouraged when cost, schedule, and technical improvements can be demonstrated.

NASA is committed to successfully infusing new technologies that will lower mission costs into its programs. However, the short definition and development time available for ESSP missions generally will not allow for significant technology development after mission selection. NASA expects that the technology-driven activities such as the New Millennium Program (NMP) and

Instrument Incubator Program (IIP) will serve as the primary technology “engines” for future Earth Science Enterprise missions. Any new technology, technology development or technology enhancement required for successful performance of an ESSP mission shall be identified in the proposal, along with the risks involved and alternative approaches to mitigate the risks.

3.6 Cost Requirements

NASA funding of the missions proposed under this AO is limited by the funding identified in Section 3.1.1. Once established for a selected mission, the PI is primarily responsible to allocate the approved funds to meet cost-to-complete requirements of the mission. Where appropriate, this includes identification of credible, phased schedule and cost reserves, which are proportional to the development risk. The proposed ESE Cost cap will be considered to be fixed and committed at selection. The ESSP does not maintain a reserve pool from which missions exceeding their cost commitments may draw. Therefore, the PI must manage effectively and efficiently the allocation of available funds to avoid schedule delays and cost over-runs throughout the mission implementation phase.

The proposal shall include the Total Mission Life Cycle Cost (TMLCC) for each ESSP mission, which includes the ESE Cost, the NASA Earth Science Launch Services Cost, and all contributed costs. The TMLCC includes but is not limited to:

- Mission definition and development of all flight and ground hardware and software, acquisition of launch services, launch, and operations of a mission to observe and understand aspects of the Earth System;
- Accomplishment of any correlative measurements necessary to ensure optimum science return by calibrating or validating these observations;
- Obtaining any support needed from other organizations, missions, or projects;
- Development, operation, refinement, maintenance, documentation, and publication of all required algorithms to accomplish the mission;
- Processing, archiving, distribution, maintenance, documentation, and information management of all mission derived data products consistent with interfaces required to permit community-wide access via appropriate existing mechanisms;
- Publication of results in the refereed science literature;
- Delivery to NASA, at the conclusion of the mission, of all data, supporting information, and available results to facilitate NASA-supported preservation and dissemination;
- Assessment of orbital debris;
- Supporting NASA Earth Science Program communication and outreach goals and objectives.

The proposed NMC in Step-Two will be used to assess the science value of the mission. The Step-Two TMLCC will be evaluated to determine the adequacy of the total proposed resources to successfully carry out the mission. While the TMLCC does not enter into the science value assessment directly, contributions should increase the science return of the mission and therefore its science value.

3.7 Management Requirements

The development schedule and budgets associated with ESSP Projects demand innovative business and management practices. NASA's approach to ESSP missions encourages teaming arrangements among industrial, academic, government, and international partners. Selected mission teams will have full responsibility and authority to accomplish the mission. This will permit them to use innovative approaches necessary to stay within the strict cost and schedule limits of the program. NASA oversight and reporting requirements will be at the appropriate level to ensure mission success and agreed-upon science return in compliance with committed cost, schedule, performance, quality, reliability, and safety requirements. The overall management of negotiated cost and schedule milestones at any stage of the mission is the responsibility of the PI and failure to meet them will be cause for termination.

Mission teams shall submit, at a minimum, monthly programmatic reports that include significant accomplishments; the status of technical margins; mission risk identification, mitigation tracking and resolution; current schedule margin; and workforce. Mission teams shall provide the ESSP Office detailed schedules on a quarterly basis, at a minimum.

Mission teams shall also submit monthly and quarterly (533M and 533Q, or equivalent) financial management reports as described in NPG 9501.2C "Procedures For Contractor Reporting Of Correlated Cost And Performance Data" (23 April 1996). Mission financial management reports shall be prepared according to the WBS and cost element structure contained in the mission proposal unless changes are negotiated and approved after selection. Mission financial management reports shall be required from prime contractors as well as first-tier subcontracts that meet the reporting requirements set forth in NASA FAR Supplement Section 18-42.7201 (b) (1). Mission teams shall also provide funding profiles and explain variances between projected and actual costs, as required during mission implementation. NASA intends to use existing mission team internal management reporting systems to the maximum extent feasible in satisfying mission financial reporting requirements.

ESSP missions shall have a product assurance program that complies with the Mission Assurance Guidelines and Requirements in Appendix H, and that also meets the intent of the ISO 9000 series, American National Standard, "Quality Systems - Model for Quality Assurance in Design, Development, Production, Installation, and Servicing", ANSI/ASQC Q9001-1994. ESSP missions shall also have a mission safety plan that complies with the Flight and Ground Safety Requirements in Appendix J.

The required system level reviews for ESSP missions are described in Appendix H and are listed below. These reviews will be conducted by NASA.

- System Requirements Review (SRR),
- Preliminary Design Review (PDR),
- Mission Design Review (MDR),
- Confirmation Readiness Review (CRR),
- Mission Confirmation Review (MCR),
- Critical Design Review (CDR),
- Pre-Environmental Review (PER),

- Pre-Ship/Operational Readiness Review (PSR/ORR),
- Mission Readiness Review (MRR), and
- Flight Readiness Review (FRR).

The MDR, CRR, and MCR constitute the mission confirmation process. The purpose of the confirmation process is to establish that the Mission Team has completed an acceptable mission formulation and is prepared to begin mission implementation within the identified ESE Mission Cost cap. The MDR will follow the PDR and combine the findings of the PDR with a programmatic and process review of the proposed mission implementation. It provides an independent assessment of mission readiness and identifies the technical, financial, management, and schedule risks associated with successfully completing implementation of the mission. At the conclusion of the MDR, the Associate Administrator for the Office of Earth Science will select those missions that will proceed to MCR and, if confirmed, to implementation. The CRR examines the MDR results and establishes recommendations on mission confirmation. The MCR serves as a final gate for the mission to proceed into implementation. All of these reviews **shall** appear in the mission schedule.

In order to assess the progress of the mission and to provide NASA with necessary technical and programmatic insight, the mission team shall also develop and propose a schedule of peer reviews. NASA shall be invited to attend and participate in any peer review that the mission team conducts. The proposer may refer to the latest version of NASA NPG 7120.5 for guidance in this area. The purpose of these reviews is to assess the technical, management, cost and schedule progress of the mission, at a subsystem level, to ensure that reasonable and sound engineering and management are being employed throughout the mission definition and development cycle. These reviews will provide the mission team with an assessment of the program, provide feedback through recommendations as necessary and indicate any potential problem areas.

The selected mission team will be totally responsible for the ESSP mission, including science/applications integrity and mission implementation. In this “PI-Mode,” the PI and his/her mission team will have full responsibility for all aspects of the mission. This includes instrument and spacecraft definition, development, integration, and test; launch services (if contributed by the mission team) or mission launch interfaces (if launch service is NASA provided); ground system; science operations; mission operations; and data processing, archival and dissemination. Each mission team member shall consider themselves responsible for mission success (i.e., delivery of science data products), rather than solely for their portion of the mission. The PI may select partners from industry, academia, nonprofit institutions, NASA Centers, Federally Funded Research and Development Centers (FFRDC's), other Government agencies, and international organizations to assist in carrying out the responsibility for implementing the mission.

It is the intent of NASA to give the PI and the mission team the ability to use their own processes, procedures, and methods to the fullest extent possible. ESSP mission teams shall define the management and contractual approaches that are best suited for their particular teaming arrangement. These approaches shall be commensurate with the investigation’s implementation approach while retaining a simple and effective management structure necessary to assure the adequate control of development within the cost and schedule constraints.

Contractual approaches are encouraged that provide incentives to team members toward successful delivery of science/applications data products. Team member agreements and/or contracts shall be signed and copies delivered to NASA within 90 days of award of NASA mission contract (see Section 3.3 for international agreements). The investigation team shall develop and propose a Work Breakdown Structure (WBS) to manage mission implementation that best fits their organizational approach and mission design concept

The PI shall be the central person in each ESSP mission, with full responsibility for the scientific/applications integrity of the mission. The PI is responsible for assembling a team to propose and implement the mission. The PI shall be accountable to NASA for the scientific/applications success of the mission. The PI shall be prepared to recommend mission termination when, in the judgment of the PI, the successful achievement of the established Minimum Mission objectives is not likely within the committed cost and schedule reserves. Each selected mission team shall propose and negotiate a set of performance metrics during the Mission Definition and Preliminary Design Phase (phase 2; See Section 3.2) for program evaluation, including cost, schedule, and technical performance as appropriate. These metrics shall be incorporated into the contract. Violation of the agreed upon metrics, as determined by NASA, may be cause for termination of the investigation at any time.

Each ESSP mission **shall** have a dedicated Project Manager (PM) reporting directly to the PI, who will oversee the formulation and implementation of the mission. The role, qualifications, and experience of the PM shall be carefully considered to ensure that the programmatic and technical needs of the investigation would be met. The PM and other key individuals, such as a systems engineer, their roles, and the adequacy of their experience shall be identified for each ESSP investigation in the same manner as Co-Investigators.

Each ESSP mission shall define the risk management approach it intends to use to ensure successful achievement of the mission objectives within established resource and schedule constraints. In addition, identify any manufacturing, test, or other facilities needed to ensure successful completion of the mission's objectives.

3.8 Educational Requirements

The educational goal of the Earth Science Enterprise is to stimulate public interest in and understanding of Earth system science and encourage young scholars to consider careers in science and technology. All ESSP Step-Two proposals **shall** include an Education component that addresses one or more of the following aspects of the Earth Science Enterprise educational objectives:

- Informal Education. Increase public awareness and understanding of how the Earth functions as a system and NASA's role in enabling development of that knowledge.
- Formal Education. Enable the use of Earth science information and results in teaching and learning at all levels of education.
- Professional Development. Build capacity for productive use of Earth science results, technology, and information in resolving everyday practical problems.

The phrase, public outreach, is sometimes used in association with education in various parts of NASA. To the extent that its objective is to *enhance public understanding of science and technology* that includes the following elements:

- Appreciation of the relevance and role of science and technology, both, as a *process* and *product*;
- Accessibility of scientific information and learning as a source of empowerment;
- Analysis, evaluation, and decision-making skills; and
- Taking appropriate actions to meet personal and societal needs,

public outreach is considered a part of informal education in the Earth Science Enterprise.

The educational activities shall focus on building the learning continuum from broad-based awareness to enhanced understanding and knowledge that leads to the conscious usage of that knowledge in everyday activities. The proposed activities shall:

- Utilize external partnerships that bring together key expertise and capabilities
- Focus on the interests and needs of the targeted audiences
- Focus on scientific/applications, technological or educational themes related to the mission objective(s), and not on the mission itself
- Build in an evaluation – front-end, formative, and summative – plan with outcome measures to ensure greatest impact
- Articulate a deployment strategy that is either national in scope or can be scaled to national level at little to no additional NASA investment
- Promote the participation of the under-served and underrepresented segments of the population as represented by demographic, social-cultural, and economic variables, and mental and physical abilities
- Leverage and network existing educational activities for economy of cost and increased impact

For informal education, learning venues capable of large impact are encouraged; examples include media programming (radio, television, film, video), print (newspapers, magazines, books), on-line learning providers, museums, science & technology centers, zoos, aquarium, parks with interpretive staff, community or civic groups, etc. Particular emphasis will be placed on engaging new audiences, providing programming support, building synergy between formal and informal educational activities, as well as professional enhancement of informal learning providers and the development of effective science/applications and technology spokespersons among the science and engineering team of the proposed mission.

For formal education, the proposed activities can be in any of the program categories described in the NASA Implementation Plan for Education (<http://education.nasa.gov/implan/exec.html>). The ESE places particular emphasis on Teacher/Faculty (K-16) Preparation and Enhancement, Curriculum Support and Dissemination, Educational Technology, Support for Underrepresented Groups, and for Systemic Improvement. The content should be in the context of Earth System Science at appropriate educational levels. Proposed activities shall clearly link to national science and technology education standards (including teacher certification) and related standards in geography, environmental sciences, etc., as well as State and local standards, as appropriate.

If the proposed investigation has a significant component addressing applied use of the scientific or technological aspects of the mission results and information, the Education plan may include professional development activities that provide training and support to the targeted users in developing practical tools for solving real world problems. The proposed activities may include technical assistance/services and/or development of ancillary products such as training materials that utilize remote sensing, standards and procedures accompanying the fusion of remote sensing into operational use, dissemination, and systemic improvement of professional networks.

At least 0.5% of the overall mission proposal budget should be invested in Education. Immediately following selection of investigations, the Education Team, together with the PI and the Project Manager, is expected to work with the Earth Science Enterprise Education Implementation Office at the Goddard Space Flight Center, to develop an Education Activity Plan based on the proposed effort. The ESE Education Implementation Office is responsible for the coordination and integration of educational efforts across the Enterprise to ensure synergy between the development and delivery of learning experiences across all audiences. The final Education Activity Plan will be completed and approved during the formulation stage of the selected mission.

3.9 Other Opportunities

3.9.1 Participation of Small, Small Disadvantaged, and Women-owned Small Businesses, and Minority Institutions

Step-Two proposals shall provide a proposed subcontracting plan that discusses the subcontracting approach for the following: Small Disadvantaged and Women-Owned Small Businesses, Historically Black Colleges and Universities and other minority institutions, Veteran Owned Small Businesses, and certified Historically Under-utilized Business Zone (HUBZone) small businesses. The subcontracting approach should include subcontracting goals and the involvement of the aforementioned business types and institutions. The proposing institution(s) shall agree to use their best efforts to assist NASA in achieving its subcontracting goals. Investment in these organizations reflects NASA's commitment to increase the participation of minority concerns in the aerospace community and is viewed as an investment in our Nation's future.

NASA contracts resulting from this solicitation that offer subcontracting possibilities, exceed \$500,000, and are with entities other than small business concerns, will contain the clause FAR 52.219-9. Offerors who are selected under the Step-Two Evaluation Process under this AO, and who meet the foregoing conditions, will be required to negotiate appropriate subcontracting plans. The subcontracting plan described in the Step-Two proposal will be evaluated as part of the Step-Two Evaluation Process (see Section 5.2 and 5.3.2).

3.9.2 Commercialization

NASA is committed to enabling the economic and technical competitiveness of the United States through innovative partnerships between public sector programs within its purview and the private sector. This solicitation encourages U.S. commercial sector participation in all areas of

proposed ESSP missions including flight and ground segment development, new product or service development based on data derived from the mission, and the production of final scientific reports and public or educational outreach materials. Best available commercial processes, business practices, and technologies are encouraged to optimize the effectiveness of the project and return best value science to the primary investors, the U.S. taxpayers. Examples of commercial benefits to participating companies include new products, refinement of current products and services, and new directions for research and development of commercial offerings.

Although the evaluation process will reward those proposals that include U.S. private sector commercialization as part of the overall mission, proposals that do not include commercial participation will not be penalized.

4.0 PROPOSAL PREPARATION AND SUBMISSION GUIDELINES

4.1 Format and Content

To be considered for selection under this AO each proposer shall submit a Step-One Proposal. General NASA guidance for proposals is given in Appendix I. **A uniform proposal format is required** from all proposers to aid in proposal evaluation. The required proposal format and contents for Step-One and Step-Two proposals are summarized in Appendix K. Failure to follow this outline may result in reduced ratings during the evaluation process, or in extreme cases, could lead to rejection of the proposal without review.

Note: The tables and figures shown in Appendices K and L are **not** electronic forms. They were created using Microsoft Word and/or Excel for the purpose of illustrating the desired format for presenting the information requested in the AO. Field sizes may be adjusted if necessary provided the basic format is not changed. Also, description text should be used in the fields rather than generic headings (e.g. use actual instrument name or description rather than “instrument a.”)

4.2 Proposal Submission Information

4.2.1 Endorsements and Certifications

All proposals shall address letters of endorsement. These letters are required of all organizations that are offering goods and/or services on a no-exchange-of-NASA-funds basis, including NASA Centers, other government agencies, foreign organizations providing hardware or software to the investigation, the major participants in the proposal, and the launch service provider if the launch service is not provided through NASA. For the Step-One proposal all that is required is a one-page summary of proposed endorsements. Step-Two also requires the one page summary; as well as the letter of endorsement themselves. Letters of endorsement shall be signed by institutional or Government officials authorized to commit their organizations to participation in the proposed investigation and shall describe the offered goods/services and their associated cost/value. These officials shall certify institutional support and sponsorship of the investigation, as well as concurrence in the management and financial parts of the proposal. The summary of

the Letters of Endorsement shall be included in Section E - Endorsements of the proposal. The letters themselves shall be included in Section L – Appendices of the proposal.

4.2.2 Quantity

All proposers shall provide 35 copies of their paper proposal, including the original signed proposal, on or before the proposal deadline. The proposals shall be numbered sequentially from 1 to 35 in the upper right-hand corner of the cover page; the original signed proposal shall be number 1. These requirements apply to both Step-One and Step-Two proposals.

4.2.3 Electronic Version of Proposal

Include with your paper proposal an electronic version of your proposal as described in Appendix K. The primary evaluation will be performed using the paper version as submitted. These requirements apply to both Step-One and Step-Two proposals.

4.2.4 Submittal Address

Step-One and Step-Two proposals shall be delivered to the following address:

ESSP AO NASA Peer Review Services, Code Y
500 E. Street, SW Suite 200
Washington, DC 20024-2760

4.2.5 Submittal Deadline

All Step-One proposals **shall** be received no later than 4:00 p.m. Eastern Time on the date specified in Section 1.5. Proposals received after the established closing date and time will be treated in accordance with NASA's provisions for late proposals (NASA FAR Supplement 1815.412, Late Proposals, Modifications and Withdrawal of Proposals).

All Step-Two proposals **shall** be received on or before 4:00 p.m. Eastern Time on the date specified in Section 1.5. Proposals received after the established closing date and time will be treated in accordance with NASA's provisions for late proposals (NASA FAR Supplement 1815.412, Late Proposals, Modifications and Withdrawal of Proposals).

4.2.6 Notification of Receipt

NASA will notify proposers in writing that their Step-One and Step-Two proposals have been received. Proposers not receiving this confirmation within two weeks after submittal of their proposal should contact NASA at the address given in Section 4.2.4.

5.0 PROPOSAL EVALUATION, SELECTION, AND IMPLEMENTATION

The selection of investigations that best address the research objectives and scientific/applications questions described in Section 2.0 of the AO and that will be successfully implemented is the fundamental aim of the proposal evaluation process. ***While panel reviews will carry considerable weight, NASA reserves the right to make the final selection of proposals based on the needs of the Earth Science Enterprise, the ESSP and the research priorities stated in the AO.*** The two-step evaluation approach is designed to identify the missions with the best science/applications value to NASA and assess the probability that the proposed investigations can be achieved within established limits of cost and schedule. The information requested enables the evaluation panels to determine how well each mission team understands the complexity of the proposed mission, its technical risks, and any challenges which require specific action during the mission definition and preliminary design phase. This information will also enable the evaluation panels to rank the proposed investigations, and will provide the necessary discriminators to permit the selection of those proposals which best meet all guidelines and constraints, and which address all elements viewed necessary for mission success.

Evaluation of the Step-One Proposal is intended to assess the in-depth scientific/applications merits, justification and maturity of the proposed investigation in relation to the research objectives and scientific questions described in this AO and the overall research strategy of NASA's Earth Science Enterprise (see Section 2.0 and Appendix A). As such, the Step-One evaluation will consider the proposed scientific/applications justification and Science Traceability Matrix (see Appendix L, Figure L-3) as the basis from which overall scientific merit and ESSP/ESE program relevance are assessed. The Instrumentation Technical Maturity Matrix (see Appendix L, Figure L-2(a)) and any instrumentation heritage and/or precursors will be assessed to determine the maturity level of the proposed instrumentation. The proposed instrumentation will be evaluated for its applicability to the required physical measurements. Proposed missions that seek to address a broad variety of scientific/applications issues at various disparate levels, without attempting to resolve a particular issue, will be scored lower than focused missions that articulate a well-defined scientific justification by means of a sensitivity analysis (Appendix K, Section F-1) and Science Traceability Matrix (Appendix L, Figure L-3).

The Step-Two Proposal will be evaluated on the mission science, technical implementation, management implementation, cost, and cost realism. NASA will assess the science value of each proposed mission by integrating the science and applications merit and the NASA Mission Cost. Education and other opportunities will also be evaluated. Dependent upon the number of Step-Two proposals received and available travel funding, NASA plans to use site visits to collect additional information for the Step-Two evaluation. Your Step-Two proposal must identify the single location for the site visit. NASA recommends that you identify a site that you believe will best support demonstration of your readiness to implement the mission.

NASA will make selections for formulation based on the combined Step-One and Step-Two evaluations as described in this section. Proposed investigations selected in this evaluation process will negotiate contracts with NASA for mission formulation, including risk reduction efforts, with an option to proceed with implementation, operations and data analysis. The

mission formulation phase, leading to MDR, will be 12 months. After formulation, the Preliminary Design Review (PDR) and MDR, NASA will select those missions that best meet the goals and objectives of ESSP and ESE while demonstrating retirement of risks to proceed with the Mission Confirmation Review (MCR) process (see Appendices D and H), leading to implementation and eventual flight. As part of the MCR, NASA will assess the funding required for the selected missions against the available profile, and may negotiate any adjustments in mission schedule and launch, and their associated cost impacts.

5.1 Step-One Evaluation Criteria

The evaluation criteria listed below will be used to evaluate Step-One proposals. All proposals deemed to be compliant would be evaluated and categorized against these criteria. The Step-One criteria cover:

- Scientific/Applications Merit
- Mission Implementation

The scientific/applications merit criteria will be evaluated giving highest weight. The mission implementation criterion is of secondary importance to the scientific/applications merit criteria. The science/applications merit criterion is a measurement of quality and NASA will assign adjectival ratings as shown in Table 5.1-1. The mission implementation criterion is a measure of implementation feasibility and NASA will assign risk ratings as shown in Table 5.1-2.

Table 5.1-1 Adjectival Ratings for Science/Application, Education, and Other Opportunity Merit.

Adjective	Definition
Excellent	A comprehensive and thorough proposal of exceptional merit. One or more major strengths. No major weaknesses or only minor correctable weaknesses.
Very Good	Demonstrates overall competence. One or more major strengths and strengths out balance any weaknesses. Any major weaknesses are correctable.
Good	Reasonable sound response. There may be strengths or weaknesses, or both. As a whole, weaknesses, not offset by strengths, do not significantly detract from the offeror's response. Major weaknesses are probably correctable.
Fair	One or more major weaknesses. Weaknesses have been found that out balance strengths. Major weaknesses can probably be improved, minimized, or corrected.
Poor	One or more major weaknesses which are expected to be difficult to correct, or are not correctable.

Table 5.1-2 Risk Ratings for Technical Implementation, Management, and Cost

Adjective	Definition
Low Risk	<u>No major weaknesses.</u> Has little potential for disruption of schedule, increased cost, and/or degradation of performance. Problems encountered should be manageable with planned cost and schedule.
Medium Risk	<u>Major weaknesses are correctable.</u> There may be strengths or weaknesses or both. As a whole, weaknesses that are not offset by strengths do not significantly detract from the offeror's response. Could potentially encounter some disruption of schedule, increased cost, and/or degradation of performance. Special emphasis and monitoring will probably be able to overcome difficulties.
High Risk	<u>Major weaknesses are not correctable within proposed resources.</u> Likely to cause significant disruption of schedule, increased cost and/or degradation of performance even with special contractor emphasis and close Government monitoring.

5.1.1 Step-One Scientific/Applications Merit Criteria

NASA will use the following to evaluate the Science/Applications Merit Criteria.

- The overall scientific and/or applications merit of the proposed investigation, as measured by
 - The scientific or applications objectives and justification of the proposed investigation relative to the research objectives and scientific questions described in section 2.0 and more generally to the NASA Earth Science research strategy in Appendix A.
 - The coherence of the traceability from the proposed objectives to the measurements required to the instrument functional requirements and the instrument/mission engineering requirements.
 - The scientific resilience of the investigation, as reflected by the assessment of the minimum science mission and the proposed descope options and the sensitivity to and likelihood of reduced performance or shortened mission life if they become necessary.
- The relevance of the proposed investigation to NASA's Earth Science Enterprise research strategy, its science and application priorities, and the specific research objectives of this ESSP AO.
- The uniqueness and innovation of the proposed investigation. This will include the relationship between the proposed investigation and other approved Earth Science missions including NASA, other government, international, and commercial missions.
- The feasibility of the proposed investigation, including maturity of the underpinning research, the feasibility and risk of achieving objectives based on the proposed instrumentation and technical implementation, the risk that the investigation will not meet the objectives as proposed. Note: NASA will assess the capability of the proposed measurement to achieve the objectives under the Science/Applications criterion, and will

assess the capability of the proposed instrument to achieve the proposed measurement under the Mission Implementation criterion.

- The ability of the proposed mission to resolve the proposed scientific/applications questions through a focused mission
- The expertise and experience of the senior members for the science and applications team in relation to the proposed science or applications objectives.
- The adequacy of the correlation measurements and validation activities.
- The adequacy of the data processing and distribution plan, including analysis, archiving, and dissemination of data and results.
- Compliance with the guidelines and requirements of the AO.

5.1.2 Step-One Mission Implementation Criteria

NASA will use the following to evaluate the Mission Implementation criteria.

- Mission design, including adequacy, achievability, completeness, and traceability to high level objectives and constraints.
- Instrumentation: Note: NASA will assess the capability of the proposed measurement to achieve the objectives under the science and applications criterion, and will assess the capability of the proposed instrument to achieve the proposed measurement under the technical implementation criterion.
- Technology maturity and heritage.
- High level (cost model based) assessment of the non-binding Step-One cost estimate and the risk of exceeding the ESE Mission Cost ceiling, based on the information provided as set forth in Appendix K.
- Mission implementation, including mission size and complexity.
- Compliance with the guidance and requirements of the AO.

5.2 Step-Two Evaluation Criteria

The evaluation criteria listed below will be used to evaluate Step-Two proposals. All proposals deemed to be compliant would be evaluated and categorized against these criteria. NASA plans to use site visits to collect additional information for the Step-Two evaluation. The six criteria cover:

- Scientific/Applications Merit
- Technical Implementation
- Management
- Cost Risk and Cost Realism
- Education
- Other Opportunities

The Scientific/Applications Merit criteria is nominally more important than any other factor. The Technical Implementation, Management, and Cost Risk and Cost Realism criteria are each nominally of equal importance, and when combined may outweigh the Scientific/Applications Merit criteria. The Education and Other Opportunity criteria are of equal value and are less

important than the other criteria. The Science/Applications Merit, Education, and Other Opportunity criteria are measurements of quality and NASA will assign adjectival ratings as shown in Table 5.1-1. The Technical Implementation, Management, and Cost Risk and Cost Realism criteria are measures of implementation feasibility and NASA will assign risk ratings as shown in Table 5.1-2. The failure of a proposal to rate highly in any of the evaluation criteria could cause the proposal to be rejected if the overall mission success is in jeopardy.

5.2.1 Step-Two Scientific/Applications Merit Criteria

NASA will use the following to evaluate the Science/Applications Criteria.

- The overall scientific and/or applications merit of the proposed investigation, as measured by
 - The scientific or applications objectives and justification of the proposed investigation relative to the research objectives and scientific questions described in section 2.0 and more generally to the NASA Earth Science research strategy in Appendix A.
 - The coherence of the traceability from the proposed objectives to the measurements required to the instrument functional requirements and the instrument/mission engineering requirements.
 - The scientific resilience of the investigation, as reflected by the assessment of the minimum science mission and the proposed descope options and the sensitivity to and likelihood of reduced performance or shortened mission life if they become necessary.
- The relevance of the proposed investigation to NASA's Earth Science Enterprise research strategy, its science and application priorities, and the specific research objectives of this ESSP AO.
- The uniqueness and innovation of the proposed investigation. This will include the relationship between the proposed investigation and other approved Earth Science missions including NASA, other government, international, and commercial missions.
- The feasibility of the proposed investigation, including maturity of the underpinning research, the feasibility and risk of achieving objectives based on the proposed instrumentation and technical implementation, the risk that the investigation will not meet the objectives as proposed. Note: NASA will assess the capability of the proposed measurement to achieve the objectives under the Science/Applications criterion, and will assess the capability of the proposed instrument to achieve the proposed measurement under the Technical Implementation criterion.
- The ability of the proposed mission to resolve the proposed scientific/applications questions through a focused mission
- The expertise and experience of the senior members for the science and applications team in relation to the proposed science or applications objectives.
- The adequacy of the correlation measurements and validation activities.
- The adequacy of the data processing and distribution plan, including analysis, archiving, and dissemination of data and results.
- Adequacy of plans to minimize time between data collection and dissemination to the scientific/applications community.

- Adequacy and likelihood of success of plans to resolve outstanding science or applications issues by the completion of the Mission Design Review (MDR). Proposal team's plans shall be described.
- Compliance with the guidelines and requirements of the AO.

5.2.2 Step-Two Technical Implementation Criteria

NASA will use the following to evaluate the Technical Implementation Criteria.

- Mission design, including adequacy, achievability, completeness, and traceability to high level objectives and constraints.
- Spacecraft hardware and flight software including reliability, risk, technical maturity, development schedule, performance margins, spacecraft maturity matrix.
- Instrumentation: Note: NASA will assess the capability of the proposed measurement to achieve the objectives under the science and applications criterion, and will assess the capability of the proposed instrument to achieve the proposed measurement under the technical implementation criterion.
- Instrument Interface and Payload Integration: including definition, clarity, and simplicity of interfaces and the consistency between the requirements and constraints of the spacecraft and the instrument.
- Launch vehicle: reliability, compliance with NASA and National policy
- Manufacturing, Integration, and Test; including schedule, facilities, test planning (Hardware, software, environmental, lifetime) or adequacy of design if testing not proposed, integration to the launch vehicle.
- Ground and data systems including adequacy and completeness of proposed approach, software development, data processing approach, testing, use of appropriate standards, and spectrum allocation requirements and approach.
- Mission Operations; including adequacy and completeness of approach, facility requirements (new or existing), security and redundancy.
- Technology maturity and heritage
- Approach to limiting Orbital Debris generation and other environmental impacts during design, planning, mission operation, and safe post-mission disposal.
- Adequacy and likelihood of success of plans to resolve outstanding technical implementation issues by the completion of formulation and/or by the MCR. Proposal team's plans shall be described.
- Compliance with the guidance and requirements of the AO.

5.2.3 Step-Two Management Criteria

NASA will use the following to evaluate the Management Criteria.

- Management processes and plans, schedules and procurement strategy, including:
 - Extent and effectiveness of proactive practices
 - Decision making process
 - Internal reviews and control
 - External reviews, NASA audits and insight

- Schedule and work flow
- Procurement strategy, plan, major subcontracts, and agreements
- System Engineering
- Document Tree
- Compliance with the Earth Explorers Program Mission Deliverables
- Team organization and structure, including:
 - Clarity and appropriateness of proposed roles and responsibilities
 - Clarity of lines of authority
 - Commitment of key personnel, including principal investigator, project manager and systems engineer, and their institution.
 - Experience of key personnel
 - Documented Agreements and signatures for key mission elements
 - Plans for physical accommodations (co-location of team, etc.)
 - Commitment of the proposer's institution for resources to ensure mission success
- Risk Management Plan, including insight and control of:
 - Mission risk identification, mitigation, tracking and resolution compliant with the Earth Explorers Program Continuous Risk Management Plan, available through the ESSP Project Library (<http://essp.gsfc.nasa.gov/library.html>)
 - Schedule margins (funded)
 - Performance margins
 - Budget reserves
 - Descope options (including decision dates and resource savings)
 - Identification of risks, and risk mitigation strategies
 - Linkage between level of risk and all margins and reserves as a function of schedule or mission development phase.
 - Cost management and tracking (expected vs. actual, etc.)
- Mission Assurance and Safety, including:
 - Compliance with the Mission Assurance Guidelines and Requirements in Appendix H
 - Compliance with the Flight and Ground Safety Requirements in Appendix J
 - Compatibility with ISO 9000 or industry best practices
 - Problem/failure reporting system
 - Inspection and quality control plans
 - System level verification (ground and/or space)
 - System safety assurance
 - Software validation
 - Parts selection and control
 - Reliability analysis and identification of failure modes and single point failures
 - Management of the cost of quality
- Facilities and Equipment, including:
 - Identification of major facilities and equipment required (both existing and new)
 - Commitment that major facilities and equipment will be available within schedule and budget
- Integrated assessment of overall mission complexity and implementation risk.
- Independent validation and verification of software as needed.

- Adequacy and likelihood of success of plans to resolve outstanding management implementation issues by the completion of the Mission Design Review (MDR). Proposal team's plans shall be described.
- Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposed objectives
- Compliance with the guidance and requirements of the AO.

5.2.4 Step-Two Cost Risk and Cost Realism Criteria

NASA will use the following to evaluate the Cost Risk and Cost Realism Criteria.

- Cost Realism and validity, including:
 - Basis, heritage and quality of proposal cost estimates, particularly for the total mission cost, the spacecraft costs(if appropriate), the instruments(s) costs by subsystem, and the proposed ground data handling system(s) cost
 - Realism of the proposed budget
 - Clarity and completeness of the proposed work breakdown structure (WBS)
 - Cost estimating methodology
- Cost Risk including:
 - Adequacy of proposed cost and schedule reserves
 - Understanding of required resources and risks demonstrated in proposal
 - Linkage between technical and schedule risks, reserves (performance, budget, and schedule), and descope options
 - Past cost performance of major partners (if appropriate)
- Adequacy of reserves consistent with the level of complexity associated with different components of the proposed mission.
- Compliance with the guidance and requirements of the AO.
- Adequacy and likelihood of success of plans to resolve outstanding cost and cost related issues by the completion of the Mission Design Review (MDR). Proposal team's plans shall be described.

5.2.5 Step-Two Education Criteria

The general evaluation criteria used for all NASA Research Announcements (NRA's) are applicable here; the principle elements are the proposal's relevance to NASA's objectives, its intrinsic merit, and its cost.

- Evaluation of the Education Plan's relevance to NASA's objectives includes consideration of:
 - the potential contribution of the effort to the *NASA Educational Excellence* (<http://education.nasa.gov>)
 - the degree to which the effort contributes to the Earth Science Enterprise 10 year educational goals described in the Earth Science Enterprise Strategic Plan (November 2000; see page 26).
- Evaluation of intrinsic merit includes consideration of the following factors listed in order of decreasing importance:

- Overall educational or technical merit of the Education Plan and/or particularly effective or innovative methods, approaches, concepts, or advanced technologies demonstrated by the proposal
 - > merit of the identified educational need
 - > quality of project design; evidence of a genuine, good idea and thoroughness in implementation
 - > robustness of the education plan
 - > alignment with national agenda in science, mathematics, engineering, technology and geography education
 - > engagement of underrepresented groups in science and technology
 - > scalability, sustainability beyond NASA investment, partnerships, and “multiplier” effect
 - > when appropriate, synergy among formal, informal, and professional educational activities
- The qualifications, capabilities, and experience of the proposed Education team leader and members, or key personnel critical in achieving the proposed objectives
- Overall standing among similar proposals and/or evaluation against the state-of-the-art or acknowledged “best practices”
- Evaluation of cost of the proposed effort shall include consideration of the realism and reasonableness of the proposed cost and the comparison in relation to impact.

5.2.6 Step-Two Other Opportunities Criteria

NASA will use the following to evaluate the Other Opportunities Criteria.

- Subcontracting plans and goals for significant participation in the mission team by:
 - Historically black colleges and universities (HBCUs), other minority universities (OMUs) and tribal colleges and universities
 - Small disadvantaged business concerns in the authorized North American Standard Industrial Classification (SIC) Groups as determined by the Department of Commerce (see FAR 19.201(b))
 - Small businesses
 - Women-owned small businesses
 - Veterans-owned small businesses
 - Qualified HUBZone business
- Commercial opportunities:
 - Identification and consideration of commercialization opportunities
 - Extent of U.S. private sector commercialization involvement
 - Realism and viability of commercialization plans

5.3 Evaluation and Selection Process

Proposals received in response to this AO will be reviewed and selected in accordance with the procedures stated in NASA FAR Supplement 1872.4 as modified by this section. Evaluation panels, using scientific/applications, technical, educational, management and administrative

peers and experts, will assess the strengths and weaknesses of each proposal and will provide the NASA Headquarters Office of Earth Science with a summary report.

5.3.1 Step-One Process

The Step-One Proposals received will be peer reviewed by a scientific/applications and mission implementation peer panel and evaluated according to the evaluation criteria in Section 5.1. Evaluation of the Step-One Proposal is intended to assess the in-depth scientific/applications merits, justification and maturity of the proposed mission in relation to the science/applications priorities (identified in Section 2.0), goals and objectives of the ESSP Project in support of the overall Earth Science Enterprise. Each proposer will be provided with a determination of the scientific/applications and technical merit of the proposed investigation and instrumentation, along with a high-level risk assessment of the mission implementation approach. Based on this evaluation, each proposal will be assigned an adjectival science/applications rating and a risk assessment (see Tables 5.1-1 and 5.1-2). Using these ratings, which include feasibility of the proposed instrumentation, NASA will recommend the missions that will proceed with Step-Two, and notify each proposer accordingly.

5.3.2 Step-Two Process

Those proposers who were recommended in Step-One and those who may choose on their own to continue with the AO process will then be required to submit a Step-Two Proposal. NASA will consider only those proposals whose science/applications objectives and methodologies have been evaluated in Step-One. Any proposal whose objectives or methodologies have not been evaluated, including proposals whose objectives or methodologies have significantly changed from Step-One, will not be considered in Step-Two. Experts will assess the scientific/applications aspects of each compliant Step-Two Proposal, as well as look for changes since Step-One, in accordance with the evaluation criteria in Section 5.2. Concurrently, management, cost and technical experts shall also evaluate the implementation aspects (management, cost, and technical) of each proposal. In addition, appropriate experts will evaluate the education and other opportunities aspects of each proposal. After the individual evaluations, the panels (Science/Applications Panel, Technical, Management and Cost Panel, Education Panel, and Other Opportunities Panel) will meet to consider the total quantitative and qualitative aspects of the evaluations in order to integrate the findings of the individual reviewers. The evaluation panels may also prepare questions requesting clarification, which will be transmitted to the appropriate proposers for prompt response. After these evaluations, the ESSP Evaluation Executive Committee will meet in plenary in order to integrate the separate panels results and prepare questions that the PI's must address during site visits. Once the site visits are complete, the panels and Executive Committee, independently, will reconvene to prepare their final evaluation reports. Panel and Executive Committee evaluation reports will represent the final product of the evaluation teams. In the event that NASA decides not to conduct site visits (e.g., if the number of Step-Two proposals received and the available evaluation funding does not allow full and complete site visits for all compliant offerors), NASA will conduct the evaluation based upon the proposal as submitted without site visits.

The ESSP Evaluation Executive Committee, consisting of the ESSP Program Executive, the ESSP Program Scientist, the chairs of the individual evaluation panels, and others with the necessary expertise will, upon consideration of the reports of the evaluation panels, integrate the Step-One and Step-Two results. The Committee will provide an assessment of the science value that includes the science return, technical, management, and cost evaluations, and site visit results. The committee will then categorize all proposals in accordance with the category definitions contained in NASA FAR Supplement 1872.4 and provide its recommendation to the Selecting Official (Associate Administrator for the Office of Earth Science). The Selecting Official will then select the proposals to be funded for formulation.

NOTICE TO ALL OFFERORS: In the event that a Principal Investigator employed by NASA is selected under this Announcement of Opportunity (AO), NASA will award prime contracts to non-Government participants, including co-investigators, hardware fabricators, and service providers, who are named members of the proposing team, as long as the selecting official specifically designates the participant(s) in the selection decision. Each NASA contract with hardware fabrications and service providers selected in this manner will be supported by an appropriate justification for other than full and open competition, as necessary.

Other key provisions and instructions concerning the selection process are given in Appendix I.

5.3.3 Mission Confirmation Review Process

The Step-Two process selects nominally 3 missions that will be funded to proceed with mission formulation, a 12-month process that culminates with the MDR. NASA will then select nominally 2 to 3 missions that best meet the goals and objectives of the ESSP and the ESE to proceed with the Mission Confirmation Review. The confirmation process will be conducted in accordance with the description in Appendix D. Nominally two missions will be confirmed to proceed into implementation and flight.

5.4 Contract Administration and Funding

Different mission management approaches and organizational arrangements may require different contract administration and funding arrangements. The PI is expected to recommend, as part of the teaming arrangement, the organizations and contract mechanisms NASA should consider in awarding work to the team. Participation by international partners will be on a no-exchange-of-NASA-funds basis. NASA will directly fund or transfer funds to participating NASA Centers or other US Government Agencies based on the PI's recommendation.

For missions selected for formulation a result of this AO, the proposed cost to complete the efforts leading to the Mission Design Review, as well as the ESE Mission Cost cap, will be considered to be fixed and committed to at the Step-Two selection. The ability of the PI to meet the proposed ESE Mission Cost cap will be re-evaluated at the MDR and during the MCR process. A post-selection survey may be conducted by the ESSP Project Office to ensure that commitments of equipment, technical resources, facilities, and letters of agreement between affiliated mission team members reflect the written proposal, the Statements of Work, and other proposed contract documents.

In order to expedite contract award after selection, all proposed contractual documentation, if accepted by NASA, will be considered executable upon selection. However, NASA reserves the right to negotiate all contract terms and conditions following the mission selection.

6.0 CONCLUSION

The ESSP Project represents a challenging and innovative approach for NASA to accomplish important scientific investigation of the Earth system. It provides an opportunity for frequent flights to execute science investigations at the forefront of Earth System Science to secure answers to key and strategically important Earth Science questions through a variety of partnership arrangements and investment opportunities. Given the limited experience base in this area, NASA is prepared to assist prospective proposers in identifying technical and management partners to assure the team's success. NASA invites both the U.S. and international science communities to participate in proposals for ESSP missions to be carried out as a result of this Announcement.

We envision that the ESSP Missions, together with other Earth Observing Satellites that are being developed by NASA and its domestic and international partners, will provide unprecedented observational capabilities for examining practically all aspects of the Earth System from space in the early part of this century. The geospatial information resulting from these observations, coupled with the revolutionary computational and telecommunications technologies, are the essential means by which the Earth science and applications communities can explore how the Earth system is changing and assess the consequences for life on Earth. The societal benefits of this national and international investment are improved and extended short-term weather forecasts, climate prediction, and assessment and prediction of natural hazards. The NASA Earth Science Enterprise is proud to have the privilege of pushing the frontiers of scientific discoveries and exploration of our home planet, Earth, to secure the necessary scientific knowledge for establishing sound policy and economic decisions and accommodating the application of this knowledge towards solving practical societal problems in food/fiber production, management of natural resources, and transportation and infrastructure.

Original Signed By

Dr. Ghassem R. Asrar
Associate Administrator
Office of Earth Science
NASA Headquarters